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(56) Documents Cited

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GB 2206750 A

WO 93/02887 A1

US 5495908 A

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(58) Field of Search

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(54) Abstract Title

Electric motor vehicle

(57) An electric motor vehicle in which an alternating current electric traction drive 6 is powered from a high-energy battery 2 via an inverter 4, additionally has means coupled to the battery 2 for deriving alternating current at domestic line voltage and for feeding this current to an externally accessible socket 10 for connection of an external load. The AC at domestic line voltage may be provided by a second output from inverter 4, this output being connected to socket 10 via a switch 14. Alternatively, AC at domestic line voltage may be derived from battery 2 by means of a bidirectional battery charger (8', Fig.2), the output socket (10') then being connected in parallel with a feed line (12') which connects charger (8') to an external supply. The socket 10 may be located on an outer wall of the vehicle or in the interior of the vehicle. A display may indicate/control the amount of energy drawn from socket 10, or may indicate the state of charge of battery 2. Means may be provided to block drawing of current from socket 10 when the battery 2 has inadequate charge or an unacceptable temperature, or when the traction drive 6 is switched on.

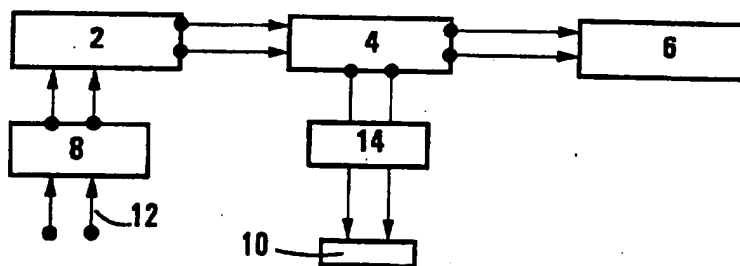


FIG 1

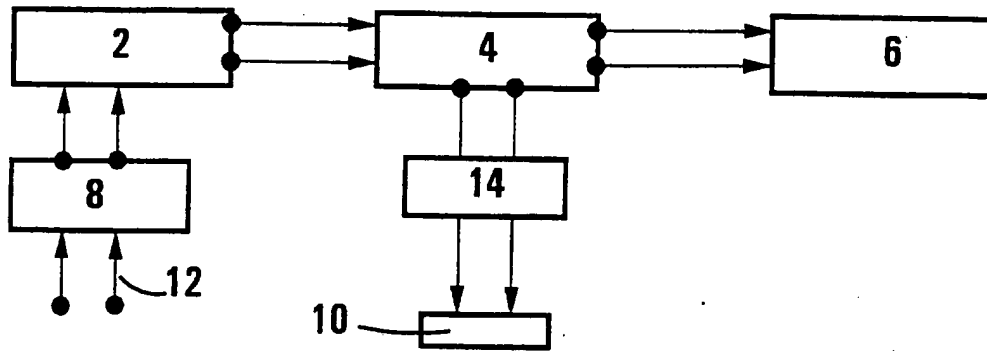


FIG 1

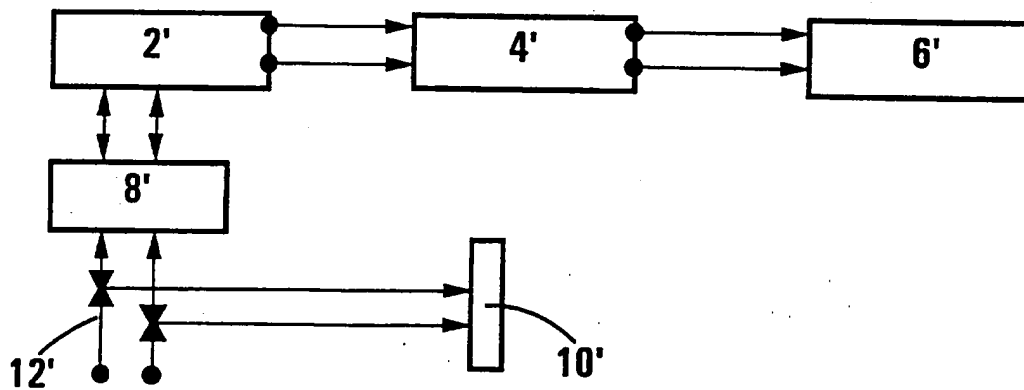


FIG 2

AN ELECTRIC MOTOR VEHICLE HAVING AN AC DOMESTIC VOLTAGE OUTPUT  
SOCKET

5 The present invention relates to an electric motor vehicle, having a high-energy battery, a charging device connected to the battery, and a current inverter connected to the high-energy battery, which current inverter is in communication with an electric drive fed with alternating current. Battery-operated electric motor vehicles of this kind are already known and are currently in use.

10 Electric motor vehicles of this type are described in DE 4107391 A1 and in an article at pages 9-14 in the magazine ABB Technik 2/88.

15 As a rule, electric motor vehicles have two independent power networks. One network serves to feed the drive system, i.e. the electric drive. The other power network serves to feed signalling and safety devices, e.g. lights and indicators.

20 In addition, it is known for the socket of the cigar/cigarette lighter of a motor vehicle, or, more precisely, the starter-lighting-ignition (SLI) battery thereof, to be used for operating appliances which are not firmly or permanently connected to the vehicle, e.g. telephones, cooling boxes, portable lights, vacuum cleaners, and the like. Any major withdrawal of energy is, however, limited because of the low capacity of the SLI battery, and use is thus restricted to a short period of time or to devices having a low energy requirement. This holds true, in particular, when the SLI battery is not continuously charged, for example by the alternator of a motor vehicle. The low DC voltages of the SLI battery (6, 12 or 24 volt) and the costs of a DC/AC inverter required for operating AC appliances result in that use is made only of DC appliances which operate on battery voltage. When, in exceptional cases, there is nonetheless a demand for AC current at domestic line voltage (110V in the USA and 220/240V in Europe and Africa) from the SLI battery or a separate auxiliary battery to power special

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appliances, a current inverter or a chopper and a transformer are necessary for transforming the battery voltage up to the line voltage. The above limitations with regard to performance or operating time also apply to such appliances operating on AC current from batteries of the SLI type.

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The use of electric motor vehicles having high-energy batteries, which have a high energy content and a high kilowatt output, with a high voltage above the domestic line voltage, makes it possible, in principle, to connect external heavy-duty electrical appliances which must be operated using alternating current at domestic line voltage.

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An object of the present invention is to provide an electric motor vehicle having an additional alternating-current network, which is suitable for supply alternating current at domestic line voltage to external electrical appliances or devices.

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According to the invention, there is provided an electric motor vehicle, which includes

a high-energy battery;

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a drive current inverter connected to the battery;

an alternating current electric drive which is connected to the drive current inverter to be supplied, in use, with alternating current;

an inverting means connected to the battery for supplying AC current at a domestic line voltage; and

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an output socket which is connected to the inverting means for connecting alternating current electrical devices, the output socket being accessible from outside the vehicle.

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In a first embodiment the inverting means may comprises the drive current inverter.

However, the motor vehicle may have a bi-directional charging device

connected to the battery for supplying DC charging current to the battery with an input socket for connection to a domestic supply which is connected to the charging device by means of a feed line. In this case, in a second embodiment of the invention, the inverting means may comprise the charging device and the output socket is connected to the feed line.

The socket, which is preferably provided on an outer wall of the vehicle and is accessible from the outside, permits the connection of external electricity-consuming devices in a convenient manner.

According to the second embodiment at least one output socket is provided on the vehicle, the charging device being connectable to an external net and being equipped for a bidirectional current flow in the feed line. The output socket is connected to, or connected in parallel with, the feed line and supplies current at domestic line voltage. This embodiment is suitable for cases in which a charging device for the high-energy battery is available in the vehicle. It is possible for the charging device, if it is bidirectional, i.e. if it is designed to operate with current flow in both directions, to be used to feed the additional alternating-current network. Circuits for bidirectionally operating charging devices are known, for example from uninterruptible power supplies (UPS). For safety reasons, the external contacts for the two current-flow directions (input and output) are separated spatially. A feed line, preferably having a protected plug, is used for the feeding of current into the on-board charging device. For the delivery of current from the on-board charging device, the output socket, which is connected in parallel with the feed line and is connected thereto, is used.

Protected plugs (connectors) for electric motor vehicles, according to German standards VDE 0623, Part 5, and DIN IEC 23H/73, are connected to the vehicle by means of flexible cables. The safety specifications are described in said standards.

It is possible for the output sockets of the additional alternating-current network to be designed as external or internal connections. In the former case, the sockets are located on an outer wall of the vehicle and are accessible from the outside. In the latter case, the sockets are preferably disposed behind a rear or trunk lid in the vehicle interior. In both cases, convenient access from the outside is required for the use as intended.

A display is preferably provided for the amount of energy drawn from the additional alternating-current network. In addition, a separate meter is preferably provided for controlling the amount of energy drawn or for displaying the state of charge of the high-energy battery. Finally, means are preferably provided for blocking the drawing of line current under unacceptable operating conditions, e.g. inadequate state of charge or unacceptable temperature of the high-energy battery, or when the vehicle drive is switched on.

Further advantages, features and possible uses of the present invention are set out in the following description of two exemplified embodiments, with reference to the drawing, in which:

Figure 1 shows a first embodiment of the block diagram of an electric motor vehicle according to the invention.

Figure 2 shows a second embodiment of the block diagram of an electric motor vehicle according to the invention.

Figure 1 shows a high-energy battery 2 which is connected to a current inverter 4 which converts the direct current supplied by the high-energy battery. On the one side, the inverter 4 is connected to an electric drive 6, e.g. an electric motor. On the other side, the inverter 4 is connected to a socket 10 for the withdrawal of AC current at domestic line voltage for an external electricity-consuming device. A charging device 8 is connected to the high-energy battery 2 and is connected to a feed line 12 for charging the high-energy battery 2. The feed line 12 is equipped for connection to an external supply. The supply of

current to the socket 10 may be blocked in any suitable manner. For example, a switch 14 is shown.

5       The alternative embodiment illustrated in Figure 2 comprises a high-energy battery 2' which is connected to a current inverter 4'. Said current inverter 4' is electrically coupled to the electric drive 6'. A charging device 8', for charging the high-energy battery, is connected to said battery. The charging device 8' has a feed line 12' and is capable of bidirectional current flow. A socket 10', with corresponding leads, is connected to, or connected in parallel with, the feed  
10    line 12'. The socket 10' is used for connecting an additional AC device at domestic line voltage. When the charging device 8' is not being used for charging the high-energy battery 2', it may be operated in a direction opposite to the direction of the charging drive and it feeds the socket 10'.

## CLAIMS

1. An electric motor vehicle, which includes  
a high-energy battery;  
5 a drive current inverter connected to the battery;  
an alternating current electric drive which is connected to the drive current  
inverter to be supplied, in use, with alternating current;  
an inverting means connected to the battery for supplying AC current at a  
domestic line voltage; and  
10 an output socket which is connected to the inverting means for connecting  
alternating current electrical devices, the output socket being accessible from outside  
the vehicle.
2. An electric motor vehicle as claimed in Claim 1, in which the inverting  
15 means comprises the drive current inverter.
3. An electric motor vehicle as claimed in Claim 1, which includes a bi-  
directional charging device connected to the battery for supplying DC charging  
current to the battery; and  
20 an input socket for connection to a domestic supply which is connected to the  
charging device by means of a feed line;  
in which the inverting means comprises the charging device and the output  
socket is connected to the feed line.
- 25 4. An electric motor vehicle as claimed in Claim 1, 2 or 3 in which the output  
socket is located on an outer wall of the vehicle.

5. An electric motor vehicle as claimed in Claim 1, 2 or 3 in which the output socket is located in the interior of the vehicle.

6. An electric motor vehicle as claimed in any one of Claims 1 to 5 which includes a blocking means for blocking the drawing of current from the output socket.

7. An electric motor vehicle as claimed in Claim 1 substantially as specifically described herein with reference to Figure 1 or Figure 2 of the accompanying drawings.



Application No: GB 9811518.1  
Claims searched: 1 to 7

Examiner: M J Billing  
Date of search: 10 August 1998

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.P): H2H HAJ, HBCD, HBCE, HBCF, HBCG, HBCH, HBD, HDV, HQV.  
Int Cl (Ed.6): B60L 1/00, 1/02, 1/14, 11/18; B60R 16/02, 16/04; H02J 7/00, 7/02.  
Other: ONLINE - WPI.

### Documents considered to be relevant:

| Category | Identity of document and relevant passage  | Relevant to claims |
|----------|--|--------------------|
| Y        | GB2278745A (TUBB) - whole document   | 1,3,6 at least     |
| Y        | GB2206750A (POWAMATE) - Fig.1; abstract  | 1,3,6 at least     |
| X        | WO93/02887A1 (TECHNOLOGY PARTNERSHIP) - Figs.7,13,14; page 14 line 6 to page 15 line 8, page 22 line 15 to page 23 line 33 | 1,2,3,6 at least   |
| Y        | US5495908 (HITACHI) - Fig.1; abstract  | 1,3,6 at least     |
| Y        | US5309073 (HITACHI) - Figs.6-8   | 1,3,6 at least     |
| Y        | US5175439 (BOSCH) - Fig.4; column 1 lines 56-65, column 3 lines 14-19  | 1,3,6 at least     |

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|---|---|---|--|
| X | Document indicating lack of novelty or inventive step   | A | Document indicating technological background and/or state of the art.  |
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